Precision Navigation and the demand for Coastal Intelligence

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AAPA Harbors & Navigation Committee Meeting
September 16, 2015
Precision Navigation

The ability of a vessel to safely and efficiently navigate where sea room is limited with statistical certainty.
CRUISE SHIP FINALLY DOCKS IN TAMPA AS FOG SUBSIDES

MANY Passengers STILL ON SHIP DUE TO Hotel ROOM SHORTAGE
The Goal of Precision Navigation

Improve Safety
• Reduce risk of collisions/allisions
• Reduce risk of groundings/port closures
• Reduce risk of oil spills

Improve Efficiency
• Optimize cargo loading
• Reduce lightering costs
Ocean to Shore & Shore to Store

Supporting Data
- Weather
- National Spatial Reference System
- Navigational Charts
- Observations and Forecasts
Precision Navigation

- Wind Forecasts
- Current Forecasts
- Gridded Bathymetry

Salinity Forecasts
- Current Obs
- Salinity Obs

Wave Forecasts
- Wave Obs

Water Level Forecasts
- Wind Obs
- Water Level Obs

National Spatial Reference System
Port of LA/Long Beach Project

**Challenge**

- Very large tankers enter the Port of Long Beach
- How we can reduce the risk they touch bottom?

**Diagram:**

- **Ship Motion Due to Ocean Swells**
  - With zero pitch:
    - 76’ MLLW
    - 65’ max draft per COTP
    - 11’ under keel clearance
  - With one degree of pitch:
    - 76’ MLLW
    - 65’ max draft per COTP
    - 1.4’ under keel clearance

*With one degree of pitch, there is a 9.6’ increase in draft for a 1,100 foot tanker.*
The ProTide Under Keel Clearance Report

Tanker 006
Advice: 15 (inbound)

Request ID: 11

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Dimensions</th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strip</td>
<td>Str 306 (61 T006)</td>
<td>265 m x 49 m</td>
<td>263000 tons</td>
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<tr>
<td>Draft f/m/a</td>
<td>20.46 m</td>
<td>20.46 m</td>
<td>20.46 m</td>
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<tr>
<td>Berth</td>
<td>Harbor entrance 23.16 m (inbound)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Water displacement: 234294 tons
GM: 7.73 m
K0: 0.4 m
Roll period: 13.71 s

Calculation:
- Long Beach 0.017% probability
- Vertical motion calculation method: Amancon - 20 spectrum
- Expected mean start time: -
- Speed regime: Average
- Use manual predictions: No
- Use channel bottom elevations: No
- Calculated by: Tull Roes (2014-08-27 09:29)

Advice:

<table>
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<tr>
<th>Location</th>
<th>Kms</th>
<th>Date/Time Reference</th>
<th>Date/Time Close</th>
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<tbody>
<tr>
<td>Outside breakwater</td>
<td>9.66</td>
<td>2014-08-22 00:20:39</td>
<td>2014-08-22 01:15</td>
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<tr>
<td>Breakwater entrance</td>
<td>4.06</td>
<td>2014-08-22 00:30:40</td>
<td>2014-08-22 01:20:40</td>
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<td>Breakwater entrance</td>
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<td>2014-08-22 00:30:40</td>
<td>2014-08-22 01:20:40</td>
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<tr>
<td>Inside breakwater</td>
<td>1.17</td>
<td>2014-08-22 01:15:00</td>
<td>2014-08-22 02:15:43</td>
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<tr>
<td>Harbor entrance</td>
<td>0</td>
<td>2014-08-22 01:16</td>
<td>2014-08-22 02:53:53</td>
</tr>
</tbody>
</table>

Statistics:
- Maximum bottom touch probability (upper bound of reliability): 7.76-06
- Mean under keel clearance: 4.15 m
- Mean under keel clearance with squall reduction: 3.97 m
- Wait time: 00.15
- Down time: 31.51%
Nearshore Wave Prediction System

NWPS Significant Wave Height (ft) and Peak Wave Direction
Hour 3 (09Z04MAR2015)

**EXPERIMENTAL**
Coastal Data Information Program Wave Buoy
The Importance of Forecast Water Levels

Baltimore Water Levels

NOAA/National Ocean Service
Chesapeake Bay Operational Forecast System (CBOFS2)

Observation:
Tidal Prediction:
Nowcast:
Forecast Guidance:
Integrated Environmental Information and the Chart
NOAA’s commitment

http://www.nauticalcharts.noaa.gov/mcd/enc_overlays.html
Prototype Products
Precision Navigation Tool Demo
THANK YOU!